Amendments to the Claims

1. (currently amended) A method for shaping a spectrum of an impulse radio signal, comprising:

generating a set of ultrawide bandwidth basis pulses at a plurality of frequencies and a plurality of random delays;

optimizing, jointly, weights and delays as a solution to a quadratic optimization problem to approximately minimize a deviation of the spectrum from ~~a spectral mask~~ an ultrawide bandwidth spectral mask, in which the spectral mask is designed for indoor channels and limits power as a function of frequency in the spectral mask;

orthogonalizing and normalizing the set of ultrawide bandwidth basis pulses; and

applying a branch and bound procedure to the set of orthogonalized and normalized ultrawide bandwidth basis pulses to optimize the delays.

weighting the set of ultrawide bandwidth basis pulses by the weights;

delaying the set of basis pulses by the random delays; and

combining linearly the weighted and delayed basis pulses to conform the spectrum to the ultrawide bandwidth spectral mask, and wherein the weights and delays are fixed over time for the spectral mask, and wherein the ultrawide bandwidth basis pulses are selected from a set of basis pulses by a combinatorial optimization using training spectral masks.

2. (currently amended) A method of claim 1 further comprising:

shifting frequencies of the weighted and randomly delayed ultrawide bandwidth basis pulses before the combining.

3. (canceled)

4. (original) The method of claim 1 wherein the weights and delays vary over time to adaptively shape the spectrum.

5. (currently amended) The method of claim 1 wherein the ultrawide bandwidth basis pulses are Gaussian in form.

6. (original) The method of claim 1 wherein the weighting and delaying are performed by a set of filters and a set of delay lines, and the combining is performed by an adder.

7. (original) The method of claim 1 further comprising:

evaluating a cost function to determine the weights and delays.

8. (original) The method of claim 7 wherein the cost function, f, includes first and second functions f_1 and f_2, and

$$f(\underline{p}(t), S) = \alpha f_1(\underline{p}(t)) + \beta \sum_{M(\Omega)\in S} f_2(\underline{p}(t), M(\Omega)),$$

where α and β are predetermined constants, $S = M(\Omega)$ denote the spectral mask, and $\underline{p}(t)$ denotes the set of basis pulses, and the first function f_1 models a cost of generating the basis pulses, and the second function f_2 models an approximation error.

9. (original) The method of claim 1 wherein the delays are fixed, and further comprising:

solving a quadratic optimization problem to approximately minimize a deviation from the spectral mask.

10. (original) The method of claim 9 further comprising:

refining the weights and delays by a non-linear optimization.

11. (original) The method of claim 10 wherein the non-linear optimization is performed by a back-propagation neural network.

12. (original) The method of claim 10 wherein the non-linear optimization is performed by a multiple-layer neural network

13. (original) The method of claim 10 wherein the non-linear optimization is performed by a simulated annealing process.

14. (canceled)

15. (previously presented) The method of claim 1 further comprising:

selecting the set of basis pulses from a candidate set of basic pulses by greedy addition to optimize the delays.

16. (previously presented) The method of claim 1 further comprising:

selecting the set of basis pulses from a candidate set of basic pulses by greedy removal to optimize the delays.

17. (original) The method of claim 1 further comprising:

orthogonalizing and normalizing the set of basis pulses; and

applying a branch and bound procedure to the set of orthogonalized and normalized basis pulses to optimize the delays.

18. (original) The method of claim 1 wherein bounds of the branch and bound procedure are determined by Cauchy's interlacing theorem of eigenvalues for symmetry matrices.

19. (original) The method of claim 1 wherein the branch and bound procedure further comprises:

constructing an enumeration tree with an increasing number of zeros in vectors representing the delays.

20. (canceled)

21. (currently amended) A system for shaping a spectrum of an impulse radio signal, comprising:

means for generating a set of ultrawide bandwidth basis pulses at a plurality of frequencies and a plurality of random delays

means for optimizing, jointly, weights and delays as a solution to a quadratic optimization problem to approximately minimize a deviation of the spectrum from ~~a spectral mask~~ an ultrawide bandwidth spectral mask, in which the spectral mask is designed for indoor channels and limits power a function of frequency in the spectral mask;

a set of delay lines configured to delay the set of basis pulses by the random delays; and

an adder configured to combine linearly the weighted and delayed basis pulses to conform the spectrum to ~~a spectral mask~~ the ultrawide bandwidth spectral mask, and wherein the ultrawide bandwidth basis pulses are selected from a set of basis pulses by a combinatorial optimization using training spectral masks.

22. (original) The system of claim 21 further comprising:

a set of oscillators configured to shift frequencies of the weighted and delayed basis pulses before the combining.